Magnus Gålfalk / 2004-05-06

RECOMMENDED TASKS FOR REDUCTIONS

There are several ways to reduce observations in IRAF. One is to use special tasks for bias, dark and flatfield calculations. These tasks are called "zerocombine", "darkcombine" and "flatcombine" respectively.
However, some packages must be loaded first, so if you want to use these tasks then type:

"noao", "imred" and finally "ccdred"

However, I highly recommend using "imcombine" instead of all these tasks (for bias, dark, and flats). This task has more parameters and have more control (and understanding) of what is really happening. It could however be a good exercise to try the first three tasks as well and compare the results with the ones from imcombine.

MASTER BIAS

Make a list of all bias exposures that will be used to calculate the master bias, and call it e.g. bias.list.
What gives the best results ? Using a mean filter, median filter or something else ?
Parameters to think about are e.g. 'combine', 'reject', 'scale' and 'zero' when using imcombine.
Similar parameters are used with zerocombine.

MASTER DARK

Dark exposures have much longer integration times and probably have much more comsic ray hits than the bias exposures. Calculate a dark frame from your dark list (e.g. dark.list) using darkcombine and / or imcombine.
The resulting dark frame should be bias subtracted using the master bias and then divided by the dark exposure time so that we get units ADU / second. This is easily done with two imarith tasks.

MASTER FLAT

The first thing to do here is to subtract the master bias from all flat field exposures. Use a list of flatfield exposures and subtract the master bias from all raw flatfields with the imarith task to get bias subtracted flats (don't overwrite).
Then, use flatcombine or even better imcombine to get one flat from the list of flats.
The resulting flatfield is still not normalized, and since we will flatfield the science observations by dividing with a flat, it should be close to 1 in the centre region. Therefore, use the task imstat to find out the constant to divide the flatfield with, e.g. imstat specflat[500:1499,500:1499] gives the mean, median etc. in a 1000x1000 region centred on the image "specflat.fits". The normalization can then be carried out with imarith to give the master flat.

FIXING LAMP VARIATIONS IN THE SPECTROSCOPIC FLAT

It will probably be necessary to fit polynomials along the slit direction of the spectroscopic flat due to uneven lighting from the Halogen lamp in the slit direction. This function is then used to "flatten the flatfield".
This may also be necessary in the dispersion direction due to the lamp temperature (and therefore the spectra of the lamp). If an absolute calibration is done late on (not part of this exercise), this will be fixed automatically.

In order to fit the lamp variations (starting with the variations along the slit), we need to load some packages:

twodspec
longslit

The task to be used is called "response". In the parameter editor we get after typing epar response, the first two parameters should be the input spectroscopic flat and the third parameter the corrected (output) flat.
Use interactive fitting. Polynomials of very high order (up to 10th order) is probably necessary for the fit. The order is changed in the interactive fit window by typing e.g. ":order 10", pressing return and then the key " f ".
When everything looks fine, quit the fit window by pressing ' q '. Check out the flatfield and compare with before.

REDUCING THE SCIENCE DATA

Test the masterbias, dark and flats on a science exposure by removing the masterbias, the correct amount of the masterdark (mult. by exposure time of sci.target) and divide with the normalized masterflat.
Apall is a complicated (lots of parameters !) task used to extract spectra in the reduced image.